UTAH DAM SAFETY PROGRAM
Dam Design Review Checklist for
Moderate and High Hazard Dams

This checklist is designed to assist in the review process. It is not all-inclusive.

Summary Table

Dam Name:	
Dam Number:	
Owner:	
Design Engineer(s):	
Location of Dam:	
Hydrology/Basin Information:	
Breach Flow, Width, and Time	
Population at Risk	
Hazard Classification	
100 Year Flood Flow	
500 Year Flood Flow	
Inflow Design Flood (IDF)	
Probable Maximum Flood (PMF)	
Design Storm	
Reservoir Area at Spillway	
Reservoir Storage Volume at Spillway	
Reservoir Storage Volume at Dam Crest	
Embankment Information:	
Embankment Type	
Dam Crest Elevation	
Structural Height	
Hydraulic Height	
Freeboard Height	
Upstream Slope	
Downstream Slope	
Crest Length	
Crest Width	
Seismic Information:	
5000 Year Background Acceleration	
Maximum Credible Earthquake (M & PGA)	
Spillway Information:	
Spillway Type(s)	
Spillway Crest Elevation(s)	
Spillway Length(s)	
Fuse Plug Dimensions	
Primary Spillway Discharge Capacity	
Total (Prim. & Emerg.) Spillway Capacity	
Outlet Information:	
Outlet Size and Type	
Maximum Outlet Discharge Capacity	

Dam Name: _____
Dam Number: _____
Owner: _____
Date(s) Reviewed: _____

Stage of Design
____ **Preliminary**
____ **% Complete**
____ **Final**

I. DESIGN REPORT

A. Hydrology and Hydraulics Report (Revision Date _____) Reviewers Initials_____

____Drainage basin area (_____sq mi) and vegetation/soil description

____Hydrograph Analyses

____*Storm recurrence interval*

____*Runoff calculation method*

____*Flood routing method*

____*Lag time*

Storm Events	Precipitation	Infiltration Rate (AMC II / AMC III)	Flow AMC II	Flow AMC III
100 Year				
6 Hour				
72 Hour				
500 Year				
6 Hour				
24 Hour				
72 Hour				
IDF/USE				
6 Hour				
72 Hour				
HMR 49 PMF				
6 Hour				
72 Hour				

____Spillway design (for primary, auxiliary, and emergency spillways)

____*Does the design capacity satisfy SEF?*

____*Backwater effects considered?*

____*Stilling basin / energy dissipation type identified?*

____Incremental Damage Threshold

____*Flow*

____*Breach time*

____*Breach width*

____*Trigger elevation*

____*% IDF/PMF*

____Fuse plug design

____*Trigger elevation*

____*Width*

____*Breach time*

____*Backwater effects*

____Freeboard (normal pool/minimum; fetch/wave run-up)

____Reservoir area / capacity curve and table (dead storage and spillway elevations indicated?)

____Discharge curve and table for spillway

____Discharge curve and table for outlet

____Outlet design

____*Pipe type*

____*Pressurized or non-pressured*

____*Pipe size (minimum 24-inch diameter)*

____*Capable of evacuating 90% of the reservoir storage capacity in 30 days*

____*Valve type*

____*Control type and location*

____*Cradles*

____*Filters*

____*Air Vent (appropriately sized and type)*
____*Stilling basin / energy dissipation type*
____*Downstream conditions*
____*Inspection access ports*
____*Automated control issues*

Comments

B. Geologic and Seismic Study (Revision Date _____) Reviewers Initials_____
____Regional geology
____Site specific geology
____*Bedrock description*
____*Alluvial description*
____*Geologic cross-section at maximum section and along the dam axis.*
____Faults and faulting history
____Seismicity
____MCE parameters (i.e., Magnitude and PGA)
____Landslide potential of reservoir perimeter
____Other geologic hazards

Comments:

C. Geotechnical Report (Revision Date _____) Reviewers Initials_____
____Borings / test pit logs
____Exploration l*ocations map*
____*Total depth (depth > height of dam or 10' into bedrock, with a min. depth of 25' to 30')*
____*Stratigraphy with elevations of different formations*
____Depth to groundwater
____Availability of materials / borrow material analysis
____Liquefaction potential in embankment and foundation/abutment for sand like soils
____Cyclic softening potential in the foundation/abutment for clay like soils
____Dispersive potential in embankment and foundation soils

____Collapse/Swell potential in the foundation soil
____Foundation design (seepage cutoff, soil & rock treatment, grouting, etc.)
____Abutment design (seepage cutoff, soil & rock treatment, grouting, etc.)
____Embankment design (geometrics, zones, cutoff trench, etc.)
____Defensive design measures (differential settlement at steep abutment slopes, crack stopper, etc.)
____Soil/Rock zone properties (including strength parameters)
____Seepage analysis (with permeability anisotropy ratio greater than 9)
____Slope stability analyses
    ____*End of construction*
    ____*Steady-state*
    ____*Rapid drawdown*
    ____*Earthquake*
    ____*Pore pressure parameters or soil strength reduction under seismic conditions*
____Deformation analyses (seismic and non-seismic conditions)
____Cutoff trench/grout curtain design
____Internal drainage design
    ____*Chimney drain, toe drain*
    ____*Outlet conduit sand filter collar/diaphragm*
    ____*Filter design (filter capability of drain rock and pipe slot)*
____Filtering capabilities between embankment zones and foundation
____Erosion protection on both upstream and downstream slopes

Comments:

D. Structural/Others Reviewers Initials_____
____Reinforced concrete design for appurtenance structures
    ____*Spillway*
    ____*Outlet works*
____Others

Comments:

II. DESIGN DRAWINGS/PLANS (Revision Date _____) Reviewers Initials_____

A. General Plan

____Cover Sheet with Index
____Signature Block for owner's acceptance
____All drawings stamped and signed by responsible engineer(s)
____Reference to Water Rights assigned to the water storage
____Reservoir stage versus area/storage capacity curve
____Rating curves for the outlet(s) and spillway(s)
____Vicinity / location map
____Topography of site
____Bar scale and north arrow
____Plan view of dam and reservoir area (including showing locations of appurtenant structures)
____For dams over 500-feet long and with a dead-end crest, a turn-around should be provided at abut.
____Location of instrumentations (i.e., B.M., monuments (200' spacing), piezometers, staff gauge)
____Appropriate setback of fences and woody vegetation (i.e., trees) from D/S groins and toe.

Comments:

B. Details and Sections

____Cross-section of embankment at maximum section
____*Elevations of dam crest*
____*Elevations of maximum water level in reservoir (spillway crest)*
____*Freeboard*
____*Original ground line*
____*Limits of foundation excavation*
____*Geologic information / cross-section*
____*Longitudinal Cutoff trench with sideslopes ≥1H:1V*
____*Crest width (0.2*H+5 feet, 12-feet minimum)*
____*Crest slope (2-percent minimum towards the reservoir)*
____*Embankment geometrics including upstream/downstream slope and internal zones*
____*Drainage blanket minimum thickness (t≥18-inches)*
____*Chimney drain width (3- to 4-feet wide for vertical drain, 5- to 6-feet wide for inclined drain)*
____*Internal drainage system*
____*Erosion protection on both upstream and downstream slopes*
____Profile along dam axis (longitudinal profile)
____*Elevation of dam crest and centerline stationing*
____*Camber and anticipated settlement*
____*Cutoff trench*
____*Limits of foundation excavation*
____*Geologic information / profile*
____*Location of outlet(s) and spillway(s)*
____Spillway plan view, profile, and details
____*Elevation, grades, and centerline stationing*
____*Geologic information / profile*
____*Cutoff walls*
____*Energy dissipation structure*

____*Structural details for reinforcement steel*
____*Waterstops at construction joints*
____Fuse plug plan view, cross-sections, and details
____*Elevation and grades*
____*Cutoff walls*
____*Structural details for reinforcement steel*
____*Waterstops at concrete construction joints*
____Outlet works plan view, profile, cross-section, and details
____*Intake structure (with trash rack)*
____*Guard gate system*
____*Air vent pipe (appropriately sized, goose neck, rodent/basket screen)*
____*Air vent manifold (perforated holes have equivalent surface area as air vent pipe)*
____*Conduit size (minimum 24-inch diameter)*
____*Concrete cradle or encasement*
____*Battered sides 1H:<10V (unless concrete poured against excavation)*
____*Soil side-slopes ≥2H:1V (unless concrete poured against excavation)*
____*Tie down straps to prevent conduit pipe from floating during cradle/encasement installation*
____*Seepage collar/diaphragm around conduit (2-stage with min. 6-inch cover around drain pipe)*
____*Seepage collar drain pipe located off to one side of encasement (not below it)*
____*Outlet elevations and grades at both the intake structure and stilling basin*
____*Stilling basin / energy dissipation structure*
____*Inspection access port (for outlet conduit connected to a distribution line)*
____*Emergency bypass line (for outlet conduit connected to a distribution line)*
____*Automated controls*
____*Internal drainage system*
____*Sand filter and gravel drain material (2-stage)*
____*Pipe diameter (≥6-inch) – to allow for camera inspection*
____*Radius bends (≤22.5-degrees) between straight sections – to allow camera inspection*
____*Access ports – to allow for camera inspection*
____*Slot width requirement*
____*Measuring devices (i.e., V-notch boxes, bucket access, etc.)*
____*Rodent screen*
____Piezometers/Instrumentation - type and location (verify compliance w/ Well Drilling Rules, are they deeper than 30-feet and penetrate into an established aquifer?)
____Relief Wells - type and location (verify compliance w/ Well Drilling Rules, are they deeper than 30-feet and penetrate into an established aquifer?)

Comments

III. SPECIFICATIONS (Revision Date _____) Reviewers Initials_____

____Site preparation (stripping and grubbing)
____Foundation preparation
____*Compaction requirements for soil foundation*
____*Cleaning and treatment of bedrock foundation*
____*Grouting*
____*Cutoffs*
____*Abutment contacts*
____*Dental concrete / slush grout*
____*No blasting*
____Earthwork
____*Moisture conditioning at borrow and/or stockpile area only*
____*Compaction requirements for soil and rock zones*
____*Moisture content requirements*
____T*esting frequency and requirements*
____*Initial lift placement (first 2-feet) placed against concrete structures or bedrock*
____*Maximum particle size (less than 2-inches)*
____*Clay core material placed pneumatically and rolled wet of OMC*
____*Lift thickness(heavy compactors and hand operated compactors)*
____*Placement and compaction pattern of embankment material*
____*Parallel to dam axis*
____*Uniformly and horizontally (abutment to abutment, upstream to downstream)*
____*Filter and drainage material 1-foot above adjacent embankment zones*
____*Segregation, heterogeneous pockets, and 3-inch-plus rock nesting not allowed*
____*Temporary construction slopes (when & where approved by engineer) no steeper than 4H:1V*
____*Embankment compaction issues (i.e., shearing or slicken sides, rutting, heaving, cracking, etc.)*
____*Treatment of lift surface (i.e., scarification)*
____*Embankment fill (zones) gradation requirements*
____*Filter and drainage materials gradation requirements and free fall limits (to prevent segregation)*
____*Filter and drainage thickness & width requirements (blanket t≥18-inches, chimney w≥36-inches)*
____*Riprap gradation and durability (i.e. abrasion, sulfate soundness, freeze-thaw) requirements*
____*Handling of deleterious material (i.e., organics, frozen soil, debris, etc.)*
____*Frost protection for different zones (i.e., filter zones, clay core, outershell, etc.)*
____*Provisions to determine depth of frost penetration (i.e., frost tubes) during winter shutdown*
____Concrete and reinforcement
____*Concrete mix, admixtures, slump, and strength requirements*
____T*esting frequency and requirements*
____*Use of chlorides not allowed*
____*Free fall limits (to prevent possible aggregate separation/segragation)*
____*Concrete mix, placement, and curing requirements for hot/cold weather conditions*
____*Strength or age requirement before form removal / backfilling / structural loading*
____*Steel reinforcement requirements*
____*Protective cover thickness (i.e., 2" & 3" for concrete placed against wooden form or soil respectively)*
____*Waterstops and joint preparation (i.e., sand blasting)*
____*Stinging and consolidation of concrete requirements*
____*Repair requirements for damaged or improperly placed concrete (i.e., honey combing, exposed steel reinforcement, etc.)*
____Pipe materials and installation
____*Outlet conduit*
____*Bedding requirements (i.e., concrete cradle or encasement)*
____*Hydrostatic pressure test*
____*Internal camera inspection*
____*Drain pipe*
____*Pipe diameter (≥6-inch) – to allow for camera inspection*
____*Minimum radius bends (≥22.5-degrees) – to allow for camera inspection*
____*Access ports – to allow for camera inspection*
____*Slot width requirement*
____*Internal camera inspection <u>after</u> installation (preferably after 3 to 5 ft of cover)*
____*Drain pipe to be flushed cleaned or repaired if camera inspection shows any signs of debris or damage*

___Gates and mechanical systems – operation
___Piezometer installation method – hollow-stem auger in embankment area
___Dewatering during construction plan (i.e., construction in the dry, W.T. 3-feet below subgrade)

Comments

V. OTHER Reviewers Initials_____

____Water Rights Number
____Regional Engineer's review
____Construction erosion and sediment control
____Reservoir operation during construction
____Survey control
____Diversion during construction plan
____Site reclamation
____Plan for monitoring dam performance during construction
____Stream alteration permit
____Are there any cultural resources or historic properties that will be impacted by the proposed project?
____Has a cultural resource survey been conducted on the property of the proposed project site?
____Initial Filling Plan submittal
____Emergency Action Plan (EAP) submittal
____Standard Operating Plan (SOP) submittal
____Construction performance bond or Penalty (reminder only, not enforced)
____Warranty (reminder only, not enforced)
____Environmental assessment required by other government agencies (reminder only, not enforced)
____Other permits (reminder to owner/engineer of possible other permits)
i.e., 301 permit - Discharge permit (federal/DEQ regulated)
401 permit – Sediment transport (DEQ, water quality regulated)
404 permit – Alteration of stream, fill in stream or on embankment (DEQ/Stream Alternation regulated)